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LISTS OF SPECIES

Fishes from the Las Piedras River, Madre de Dios basin, Peruvian Amazon

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ABSTRACT: We report results of an ichthyological survey on the Las Piedras basin, a tributary of the Madre de Dios River located in the southwestern portion of the Amazon Basin in southeastern Peru. Collections were made at low water (June, 2011) from 180 - 270 m elevation, within the Fitzcarrald Arch. This is the last of four expeditions to the region with the goal of comparing the ichthyofaunas across the headwaters of the largest tributary basins in the western Amazon: Juruá, Ucayali, Purús and Madre de Dios rivers. Twenty-one sites along the Las Piedras River and its tributaries were sampled and a total of 144 species belonging to 32 families and seven orders were captured and identified. The most diverse families were Characidae (34 spp.), Loricariidae (23 spp.), and Pimelodidae (19 spp.).

INTRODUCTION

The Las Piedras River, also known as Tacuatimanu, is a white water river that rises in the inner portions of Fitzcarrald Arch and runs about 600 km until its mouth at the Madre de Dios River, upstream the town of Puerto Maldonado in Peru. The Fitzcarrald Arch is an area uplifted during the Pliocene (c. 4 Ma) in association with the subduction of the Nazca ridge (Espurt *et al.* 2007; 2010). Hydrologically, the Las Piedras is classified as a mid- to lowland elevation river with no direct Andean influence (Thieme *et al*. 2007).

Biogeographically, the region is included within the Mamore-Madre de Dios Piedmont Freshwater Ecoregion of the World (FEOW-318; Abell *et al*. 2008). Some work has been done on the fish fauna of the Madre de Dios basin and its tributaries in Peru and Bolivia. At least 325 fish species are known from the Madre de Dios River (Barthem *et al*. 2003). Perhaps the most comprehensive study on the ichthyofauna of the Madre de Dios basin is the one of Barthem *et al*. (2003), which identified 287 species from the region near the mouth of the Los Amigos River in Peru and illustrated 158 species and their habitat characteristics. Several local studies describe the faunal particularities within Madre de Dios River drainage and their tributaries. Those present a fish diversity of 210 species for Manu River (Ortega, 1996); 232 species for Tambopata River (Chang 1998); 95 species to Pampas del Heath (Ortega, 1994); and 52 species for the Inambari River (Palacios and Ortega 2009). However, hitherto no studies have been published for the Las Piedras River.

Here we report the results of an expedition to the Las Piedras River as part of a four-year biodiversity survey project funded by NSF called "Proyecto Alto Purus". The aim of this project is to compare the ichthyofaunas of headwaters across four major basins of the Fitzcarrald Arch: the Ucayali, Yuruá, Purus and Madre de Dios Basins (Carvalho *et al*. 2009; 2011; and Albert *et al*. 2011).

MATERIALS AND METHODS

Twenty-one localities where sampled in the Las Piedras basin, (12°30'S, 69°13'W), Madre de Dios Department, Peru (Table 1, Figure 1). Collections were made between 180 and 270 meters above sea level (m.a.s.l.) in three major types of environments: river channels and beaches (*ríos*), streams (*quebradas*), and oxbow lakes (*cochas*; Figure 2). Ríos are major rivers more than 10 meters wide; quebradas are small tributary streams less than 10 m, and cochas are oxbow lakes located on the floodplain (*cf*. Barthem *et al*. 2003). All collecting stations were georeferenced (latitude, longitude, altitude) using GPS, and habitats were documented with high resolution digital photographs and written descriptions. Collections were made using standard ichthyological gear, including

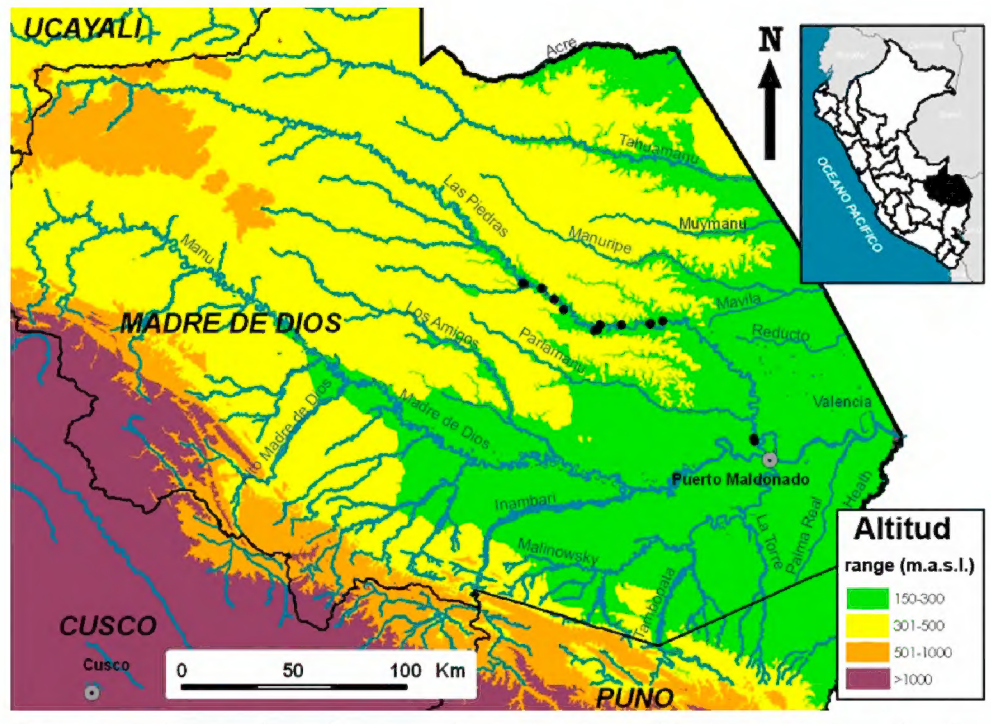

FIGURE 1. Map of study area showing the collection sites in the Las Piedras River basin, Madre de Dios drainage, Peru.

seine nets (5 and 10 m, 5 mm between knots), gill nets, dip nets, cast nets, hook and line, and trawl nets (3 m, 5 mm between knots) for sampling in deep portions of the Las Piedras River main channel. Electric fishes in streams and oxbow lakes were located with the aid of a portable amplifier (Crampton *et al*. 2007).

A reference collection was accumulated with one or more representatives of all morphospecies encountered. Tissue samples were excised using a sterilized scalpel and preserved in 95% ethanol in 1.8 ml vials, and then stored in a cool location at the base camp before transport to the laboratory. All specimens were fixed in 10% formalin for at least 48 hours in a closed Nalgene container or covered flat plastic tray (for larger specimens), and later transferred to 70° GL ethanol.

Fish specimens were photographed alive or after storage in alcohol. Photo-tank pictures were taken following techniques explained by Sabaj-Pérez (2009) with a Panasonic Lumix DMC-FZ50 (10 Mega Pixels). Fishes were identified to the lowest taxonomic level possible, using available literature and help of specialists by photo identifications. The classification presented here is based on Reis *et al*. (2003) with some additional changes proposed by Sullivan *et al*. (2006) for Siluriformes and Oliveira *et al*. (2011) for Characiformes. Voucher specimens were deposited in the fish collection of the Museo de Historia Natural da Universidad Mayor de San Marcos (MUSM), Lima, Perú and at Museu de Ciências e Tecnologia da PUCRS (MCP), Porto Alegre, Brazil. The fishes were collected under permit from the Peruvian Ministerio de la Produccion; Resolución Directoral No. 546-2009-PRODUCE/DGPP.

Results and Discussion

A total of 144 species were collected, representing 32 families and seven orders (Table 2). The families with highest species richness were Characidae (34 spp., 23%), Loricariidae (23 spp., 16%), and Pimelodidae (19 spp., 13%). The most diverse orders were all in the Ostariophysi: Siluriformes (61 spp., 42%); Characiformes (59 spp., 41%); and Gymnotiformes (14 spp., 10%). Synbranchiformes and Cyprinodontiformes were represented by a single species each. A complete photographic album of the fish species collected is provided in Appendix 1. In this study 55 species (38%) were collected in streams; 94 species (65%) in rivers, from which 12 (8%) were only captured with trawl net sampling; and 35 species (24%) in oxbow lakes.

A large number of endemic species from the upper Madeira River tributaries (Madre-de Dios, Guaporé and Mamoré) have been reported in several studies of the aquatic fauna (Albert and Carvalho 2011). Supporting that, in the Las Piedras River we found 13 (9%) species that are known only from upper Madeira basin; *Creagrutus ungulus*, *Sternarchorhynchus* cf. *hagedornae*, *Cichlasoma boliviense*, *Acestrocephalus pallidus*, *Brachychalcinus copei*, *Bryconamericus pectinatus*, *Charax caudimaculatus*, *Cynopotamus gouldingi*, *Galeocharax goeldii*, *Crossoloricaria bahuaja*, *Pterygoplichthys disjunctivus*, *Bujurquina cordemadi*, *Crenicichla semicincta* and perhaps other poorly studied taxa are endemic as well (e.g. *Aphyocharax* sp. and *Odontostilbe* sp. 1).

The Las Piedras River presents several species in common with the Paraná-Paraguay system, a pattern well known for the fish fauna from the upper Madeira tributaries (Kullander 1986; Lovejoy et al. 2010; Carvalho and Albert 2011). A total of 27 species captured at the Las Piedras River basin presents this pattern of distribution, such as *Potamotrygon falkneri* (Silva and Carvalho 2010), *Serrasalmus maculatus* (Hubert *et al*. 2007), *Otocinclus vittatus* (Schaefer 1997) and *Loricariichthys* cf. *platymetopon* (Reis and Pereira 2000), representing almost 20% of the Las Piedras ichthyofauna (see Carvalho and Albert 2011). Most of those taxa shared between the

Table 1. Description of sampled sites in the Las Piedras River, Madre de Dios basin, Peru.

LOCALITY	COORDINATES	ALT.
Beach at río Las Piedras 400 m downstream Santa Teresita	12°30'29" S 69°15'14" W	180m
Trawling at río Las Piedras downstream Santa Teresita	12°30'29" S 69°15'14" W	180m
Small stream downstream Santa Teresita	12°31'12" S 69°15'03" W	180m
Cocha Soledad at logde Soledad	12°02'47" S 69°40'33" W	238m
Río Las Piedras at lodge Soledad	12°02'56" S 69°40'39" W	238m
Beach at río Las Piedras downstream Puerto Nuevo	11°56'58" S 70°04'19" W	261m
Beach at río Las Piedras upstream Quebrada Curiacu	11°53'07" S 70°11'35" W	267m
Cocha Curiacu upstream Quebrada Curiacu	11°53'05" S 70°11'59" W	269m
Beach at río Las Piedras about 2 km downstream Puerto Nuevo	11°54'11" S 70°07'20" W	268m
Trawling at río Las Piedras about 2 km downstream Pto. Nuevo	11°54'11" S 70°07'20" W	268m
Small creek about 3 km downstream Puerto Nuevo	12°02'07" S 69°37'37" W	259m
Playa Mirador at río Las Piedras	11°59'27" S 70°01'55" W	262m
Trawling at río Las Piedras downstream Playa Mirador	11°59'27" S 70°01'55" W	262m
Drying pool near Cachuela Trigoso	12°03' S 69°53' W	256m
Beach upstream Cachuela Trigoso at río Las Piedras	12°04'12" S 69°53'44" W	256m
Small creek about 1 km upstream Cachuela Trigoso	12°04'13" S 69°54'03" W	252m
Oxbox lake exit downstream Cachuela Trigoso	12°04'21" S 69°5'11" W	254m
Small creek upstream lodge Soledad	12°03'03" S 69°47'47" W	238m
Río las Piedras at mouth of Quebrada Huascar	12°02'47" S 69°40'36" W	234m
Quebrada Huascar near mouth with río Las Piedras	12°02'06" S 69°37'37" W	234m
Quebrada Chorrera tributary to río Las Piedras	12°02'12" S 69°37'31" W	234m

Paraná-Paraguay and upper Madeira tributaries have a foreland basin distribution (*sensu* Lima and Ribeiro 2011). A large portion of the fish fauna from the Las Piedras River and Madre de Dios region is formed by species restricted to the foreland basin; e.g., *Hypostomus unicolor*, *Steindachnerina guentheri*, and *Lamontichthys filamentosus* (Vari 1991; Armbruster 2008; Paixão and Toledo-Piza, 2011). We tentatively identified 31 species (21% of the total) from the Las Piedras River restricted to the Amazon-Orinoco foreland, suggesting the importance of this area and its history in forming the regional species pool (Albert and Crampton 2010; Albert and Carvalho 2011; Lima and Ribeiro 2011).

We collected a large number of gymnotiform species (14 spp.) compared to previous inventories in the Amazon basin, probably due to use of trawl nets and portable amplifiers. In addition some species are for the first time referred for the Madre de Dios basin such as *Acestrocephalus pallidus*, *Galeocharax goeldi*, *Roeboides descalvadensis*, *Xyliphius lepturus* and *Rhinodoras boehlkei*, the last two captured only with trawl nets.

The sampled habitat with highest diversity was the "river", followed by the "stream" and the "oxbow lakes". Probably the use of trawl nets added an additional riverine assemblage of fish species, those inhabiting the bottom of the river channel. In the study by Barthem *et al.* (2003) 131 species were collected in oxbow lakes, contrasting with the 35 species registered herein in this kind of habitat. The fact that fewer species were caught in the oxbow lakes probably refers to the scarcity of this kind of habitat in the Las Piedras River basin, mainly in the upper portions of the river. Although a low number of species were collected in the "oxbow lakes" these species were highly restricted to this kind of habitat. Almost no species were shared by oxbow lakes and streams, except those generally regarded as widespread, *e.g. Hoplias malabaricus* and *Astyanax* spp.

Figure 2. Examples of sampled habitats in the Las Piedras River. Upper left corner: Quebrada Chorrera (stream). Upper right corner: Cocha Soledad (oxbow lake). Lower left corner: río La Piedras at Cachuela Trigoso (river). Lower right corner: río Las Piedras at playa Mirador (River).

Table 2. List of fish species collected in the Las Piedras River, Madre de Dios basin, Peru and their respective capture habitat S = stream, R = river and L = lake. T specimens collected only in the trawl net.

ORDER/Family/*Species*	S	R	L
MYLIOBATIFORMES			
Potamotrygonidae			
Potamotrygon falkneri Castex & Maciel, 1963		X	
Potamotrygon orbignyi (Castelnau, 1855)			X
Potamotrygon sp.		X	X
CHARACIFORMES			
Parodontidae			
Parodon sp.		X	
Curimatidae			
Steindachnerina bimaculata (Steindachner, 1876)		X	X
Steindachnerina dobula (Günther, 1868)		X	
Steindachnerina guentheri (Eigenmann and Eigenmann, 1889)			X
Prochilodontidae			
Prochilodus nigricans Spix & Agassiz, 1829		X	
Anostomidae			
Leporinus friderici (Bloch, 1794)		X	X
Leporinus striatus Kner, 1858		X	
Leporinus trifasciatus Steindachner, 1876			X
Leporinus pearsoni Fowler, 1940		X	
Schizodon fasciatus Spix amd Agassiz, 1829			X
Crenuchidae			
Characidium sp. 1		X	
Characidium sp. 2	X		
Erythrynidae			
Hoplias malabaricus (Bloch, 1794)	X	X	X
Serrasalmidae			
Serrasalmus maculatus Kner, 1858		X	
Serrasalmus rhombeus (Linnaeus, 1766)		X	
Pristobrycon sp.		X	
Acestrorhynchidae			
Acestrorhynchus falcatus (Bloch, 1794)		X	
Triportheidae			
Clupeacharax anchoveoides Pearson, 1924		X	X
Triportheus albus Cope, 1872			X
Triportheus angulatus (Spix & Agassix, 1829)		X	
Triportheus rotundatus (Jardine, 1841)			X
Gasteropelecidae			
Carnegiella myersi Fernández-Yépez, 1950	X		
Thoracocharax stellatus (Kner, 1858)		X	X
Bryconidae			
Salminus sp.		X	
Characidae			
Acestrocephalus pallidus Menezes, 2006		X	
Astyanacinus multidens Pearson, 1924	X	X	
Astyanax abramis (Jenyns, 1842)	X	X	X
Astyanax bimaculatus (Linnaeus, 1758)	X	X	
Astyanax maximus (Steindachner, 1877)	X	X	X
Astyanax sp. 1	X	X	
Astyanax sp. 2	X		
Aphyocharax pusillus Gunther, 1868		X	
Aphyocharax sp.		X	X
Brachychalcinus copei (Steindachner, 1882)	X		
Bryconamericus hypopterus Fowler, 1943	X	X	
Bryconamericus orteguasae Fowler, 1943	X	X	
Bryconamericus pectinatus Vari & Siebert, 1990	X		
Charax caudimaculatus Lucena, 1987		X	
Creagrutus ungulus Vari & Harold, 2001	X	X	
Ctenobrycon hauxwellianus (Cope, 1870)		X	X
Cynopotamus gouldingi Menezes, 1987		X	
Galeocharax goeldii (Fowler, 1913)	X	X	
Gephyrocharax sp.	X		
Hemibrycon jelskii (Steindachner, 1877)	X		
Knodus smithi (Fowler, 1913)		X	
Moenkhausia cf. *chrysargyrea* (Günther, 1864)	X		
Moenkhausia dichroura (Kner, 1858)		X	X
Moenkhausia gr. *lepidura*	X		
Moenkhausia oligolepis (Günther 1864)	X		
Odontostilbe sp. 1	X	X	X
Odontostilbe sp. 2		X	
Paragoniates alburnus Steindachner, 1876	X	X	
Prionobrama filigera (Cope, 1870)		X	
Roeboides affinis (Günther, 1868)		X	X
Roeboides descalvadensis Fowler, 1932		X	
Roeboides myersii Gill, 1870			X
Serrapinnus aff. *microdon* (Eigenmann, 1915)			X
Tetragonopterus argenteus Cuvier, 1816			X
SILURIFORMES			
Trichomycteridae			
Henonemus punctatus (Boulenger, 1887)		X	
Callichthyidae			
Corydoras aff. *aeneus* (Gill, 1858)	X		
Hoplosternum littorale (Hancock, 1828)			X
Loricariidae			
Ancistrus dolichopterus Kner, 1854			X
Ancistrus sp. 1	X		
Ancistrus sp. 2	X		
Aphanotorolus unicolor (Steindachner, 1908)		X	
Crossoloricaria bahuaja Chang & Castro, 1999	X	X	
Farlowella knerii (Steindachner, 1882)	X		
Farlowella nattereri Steindachner, 1910	X		
Hemiodontichthys acipenserinus (Kner, 1853)		X	X
Hypoptopoma incognitum Aquino & Schaefer, 2010			X
Hypostomus pyrineusi (Miranda Ribeiro, 1920)	X	X	
Hypostomus sp.			X
Lamontichthys filamentosus (La Monte, 1935)		X	
Loricaria sp.	X	X	
Loricariichthys cf. *platymetopon* Isbrücker & Nijssen, 1979	X	X	
Otocinclus vittatus Regan, 1904	X		
Planiloricaria cryptodon (Isbrücker, 1971)		T	
Pterygoplichthys disjunctivus (Weber, 1991)			X
Pterygoplichthys punctatus (Kner, 1854)			X
Rineloricaria lanceolata (Günther, 1868)	X		
Rineloricaria cf. *beni* (Pearson, 1924)	X		
Spatuloricaria puganensis (Pearson, 1937)		X	
Squaliforma cf. *emarginata* (Valenciennes, 1840)	X	X	
Sturisoma sp.	X	X	
Cetopsidae			
Cetopsis coecutiens (Lichtenstein, 1819)	X	X	
Aspredinidae			
Xyliphius lepturus Orcés, 1962		T	
Doradidae			
Leptodoras acipenserinus (Gunther, 1868)		X	
Nemadoras sp.		T	
Rhinodoras boehlkei Glodek, Whitmire & Orcés, 1976		T	
Auchenipteridae			
Ageneiosus inermis (Linnaeus, 1766)		X	

Table 2. List of fish species collected in the Las Piedras River, Madre de Dios basin, Peru and their respective capture habitat S = stream, R = river and L = lake. T specimens collected only in the trawl net.

ORDER/Family/*Species*	S	R	L
Ageneiosus ucayalensis Castelnau, 1855		X	
Auchenipterus ambyiacus Fowler, 1915		X	
Auchenipterus brachyurus (Cope, 1878)		X	
Centromochlus perugiae Steindachner, 1882	X	X	
Heptapteridae			
Imparfinis stictonotus (Fowler, 1940)	X		
Phenacorhamdia sp.	X		
Pimelodella sp. 1		X	
Pimelodella sp. 2		X	
Rhamdia quelen (Quoi & Gamard, 1824)	X		X
Pseudopimelodidae			
Microglanis aff. *iheringi* Gomes, 1946	X		
Pimelodidae			
Aguarunichthys torosus Stewart, 1986		X	
Calophysus macropterus (Lichtenstein, 1819)		X	
Cheirocerus eques Eigenmann, 1917		X	
Exallodontus aguanai Lundberg, Mago-Leccia, & Nass, 1991		T	
Hemisorubim platyrhynchos (Valenciennes, 1840)		X	
Hypophthalmus edentatus Spix & Agassiz, 1829		X	
Megalonema amaxanthum Lundberg & Dahdul, 2008		X	
Megalonema platycephalum Eigenmann, 1912		X	
Pimelodus altissimus Eigenmann & Pearson, 1942		T	
Pimelodus blochii Valenciennes, 1840		X	
Pimelodus aff. *maculatus* Lacepède, 1803	X	X	
Pimelodus pictus Steindachner, 1876		X	
Pimelodus sp. 1		T	
Pimelodus sp. 2		T	
Pirinampus pirinampu (Spix and Agassiz, 1829)		X	
Platysilurus mucosus (Vaillant, 1880)		X	
Platystomatichthys sturio (Kner 1858)		X	
Sorubim lima (Bloch & Scheneider, 1801)		X	
Zungaro zungaro (Humboldt, 1821)		X	
GYMNOTIFORMES			
Gymnotidae			
Gymnotus carapo Linnaeus, 1758	X		X
Gymnotus chaviro Maxime & Albert, 2009	X		
Rhamphichthyidae			
Gymnorhamphichthys hypostomus Ellis, 1912			
Hypopomidae			
Brachyhypopomus beebei (Schultz, 1944)	X		
Brachyhypopomus sp.	X		
Sternopygidae			
Eigenmannia macrops (Boulenger, 1897)		T	
Eigenmannia virescens (Valenciennes, 1836)	X	X	
Eigenmannia sp.	X		
Sternopygus macrurus (Bloch & Schneider 1801)	X		
Apteronotidae			
Apteronotus albifrons (Linnaeus, 1766)	X		
Apteronotus bonapartii (Castelnau, 1855)		T	
Compsaraia sp.		T	
Sternarchogiton cf. *nattereri* (Steindachner, 1868)		X	
Sternarchorhynchus cf. *hagedornae* Santana & Vari, 2010	X	X	
CYPRINODONTIFORMES			
Rivulidae			
Rivulus sp.	X		
SYNBRANCHIFORMES			
Synbranchidae			
Synbranchus marmoratus Bloch, 1795	X		
PERCIFORMES			
Sciaenidae			
Pachyurus cf. *stewarti* Chao & Cassatti, 2002		X	
Plagioscion squamosissimus (Heckel, 1840)		X	X
Cichlidae			
Aequidens tetramerus (Heckel, 1840)			X
Bujurquina cordemadi Kullander, 1986	X		
Cichlasoma boliviense Kullander, 1983			X
Crenicichla semicincta Steindachner, 1892		X	X

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Appendix 1. Voucher specimens from the río Las Piedras, Madre de Dios basin, Peru. Measurements are presented as standard length (SL).

MYLYOBATIFORMES

Potamotrygonidae

Potamotrygon falkneri, specimen not preserved.

Appendix 1. ***Continued.***

Potamotrygon orbignyi, (MUSM 37025)

Potamotrygon sp., 216 mm (MUSM 36972)

Appendix 1. ***Continued.***

CHARACIFORMES

Parodontidae

Parodon sp., 32 mm (MUSM 36914)

Curimatidae

Steindachnerina bimaculata, 57 mm (MUSM)

Steindachnerina dobula, 60 mm (MUSM 36755)

APPENDIX 1. ***CONTINUED.***

Steindachnerina guentheri, 36 mm (MUSM 36916)

CURIMATIDAE

Prochilodus nigricans, 70 mm (MUSM 36797)

ANOSTOMIDAE

Leporinus friderici, 40 mm (MUSM 36731)

APPENDIX 1. ***CONTINUED.***

Leporinus striatus, 39 mm (MUSM 36795)

Leporinus trifasciatus, 150 mm (MUSM 36730)

Leporinus pearsoni, 48 mm (MUSM 36976)

Schizodon fasciatus, 217 mm (MUSM 36729)

Appendix 1. ***Continued.***

Crenuchidae

Characidium sp. 1, 28.6 mm (MUSM 36928)

Characidium sp. 2, 39 mm (MUSM 37071)

Erythrynidae

Hoplias malabaricus, 97.2 mm (MUSM 36816)

Appendix 1. ***Continued.***

Serrasalmidae

Serrasalmus maculatus, 141 mm (MUSM 36733)

Serrasalmus rhombeus, 164 mm (MUSM 36732)

Appendix 1. ***Continued.***

Pristobrycon sp., 95.6 mm (MUSM 36734)

Serrasalmidae

Acestrorhynchus falcatus, 149.3 mm (MUSM 36721)

Triportheidae

Clupeacharax anchoveoides, (MUSM 37045)

Appendix 1. ***Continued.***

Triportheus albus, 99 mm (MUSM 36726)

Triportheus angulatus, 156 mm (MUSM 37039)

Triportheus rotundatus, 77 mm (MUSM 36727)

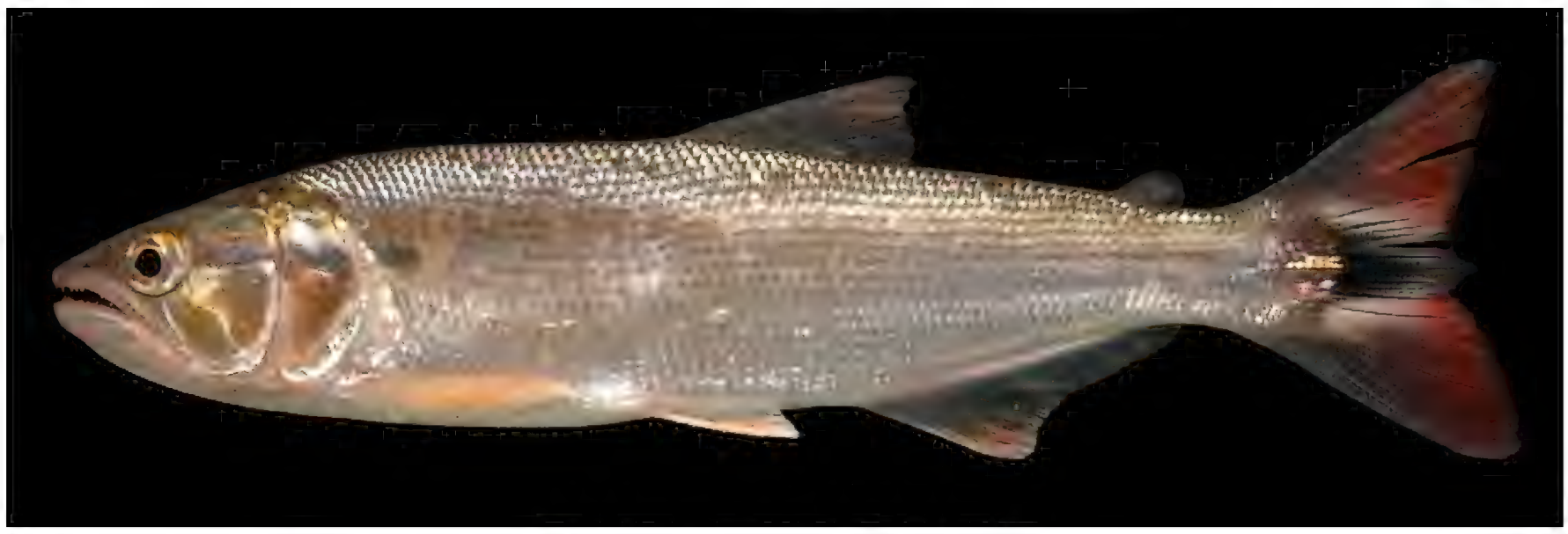
Appendix 1. ***Continued.***

Gasteropelecidae

Carnegiella myersi, 21 mm (MUSM 37104)

Thoracocharax stellatus, (MUSM 36686)

Bryconidae



Salminus sp., 139 mm (MUSM 36688)

Appendix 1. ***Continued.***

Characidae

Acestrocephalus pallidus, 42 mm (MUSM 37048)

Aphyocharax pusillus, 43 mm (MUSM 36859)

Aphyocharax sp., 30 mm (MUSM 37029)

Astyanacinus multidens, 34 mm (MUSM 36761)

Appendix 1. ***Continued.***

Astyanax abramis, 55 mm (MUSM 36717)

Astyanax bimaculatus, 77 mm (MUSM 36689)

Astyanax maximus, 54 mm (MUSM 36758)

Appendix 1. ***Continued.***

Astyanax sp. 1, 75 mm (MUSM 36800)

Astyanax sp. 2, 61 mm (MUSM 36956)

Brachychalcinus copei, 58 mm (MUSM 36944)

Appendix 1. ***Continued.***

Bryconamericus hypopterus, 64 mm (MUSM 36764)

Bryconamericus orteguasae (MUSM 36687)

Bryconamericus pectinatus, 34 mm (MUSM 37100)

Charax caudimaculatus, 55 mm (MUSM 36983)

Appendix 1. ***Continued.***

Creagrutus ungulus, 78 mm (MUSM 37009)

Ctenobrycon hauxwellianus, 38 mm (MUSM 36863)

Cynopotamus gouldingi, 92 mm (MUSM 36804)

Appendix 1. ***Continued.***

Galeocharax goeldii, 103 mm (MUSM 36690)

Gephyrocharax sp., 54 mm (MUSM 37103)

Hemibrycon jelskii, 94 mm (MUSM 37008)

Knodus smithi, 44 mm (MUSM 36806)

Appendix 1. ***Continued.***

Moenkhausia cf. *chrysargyrea*, (MUSM 37098)

Moenkhausia dichroura, 58 mm (MUSM 37028)

Moenkhausia gr. *lepidura*, 48 mm (MUSM 37083)

Appendix 1. ***Continued.***

Moenkhausia oligolepis, 33 mm (MUSM 37096)

Odontostilbe sp. 1, 22 mm (MUSM 36782)

Odontostilbe sp. 1, 22 mm (MUSM 36782)

Paragoniates alburnus, 79 mm (MUSM 36763)

Appendix 1. ***Continued.***

Prionobrama filigera, 49 mm (MUSM 37052)

Roeboides affinis, 75 mm (MUSM 37035)

Roeboides descalvadensis, 42 mm (MUSM 36858)

Appendix 1. ***Continued.***

Roeboides myersii, 85 mm (MUSM 36725?)

Serrapinnus aff. *microdon*, 17 mm (MUSM 36782)

Tetragonopterus argenteus, 43 mm (MUSM 37026)

Appendix 1. ***Continued.***

SILURIFORMES

Trichomycteridae

Henonemus punctatus, 73 mm (MUSM 36821)

Callichthyidae

Corydoras aff. *aeneus*, 44 mm (MUSM 37093)

Hoplosternum littorale, 63 mm (MUSM 36894)

Loricariidae

Ancistrus dolichopterus, 76 mm (MUSM 37034)

Appendix 1. ***Continued.***

Ancistrus sp. 1, 60 mm (MUSM 36959)

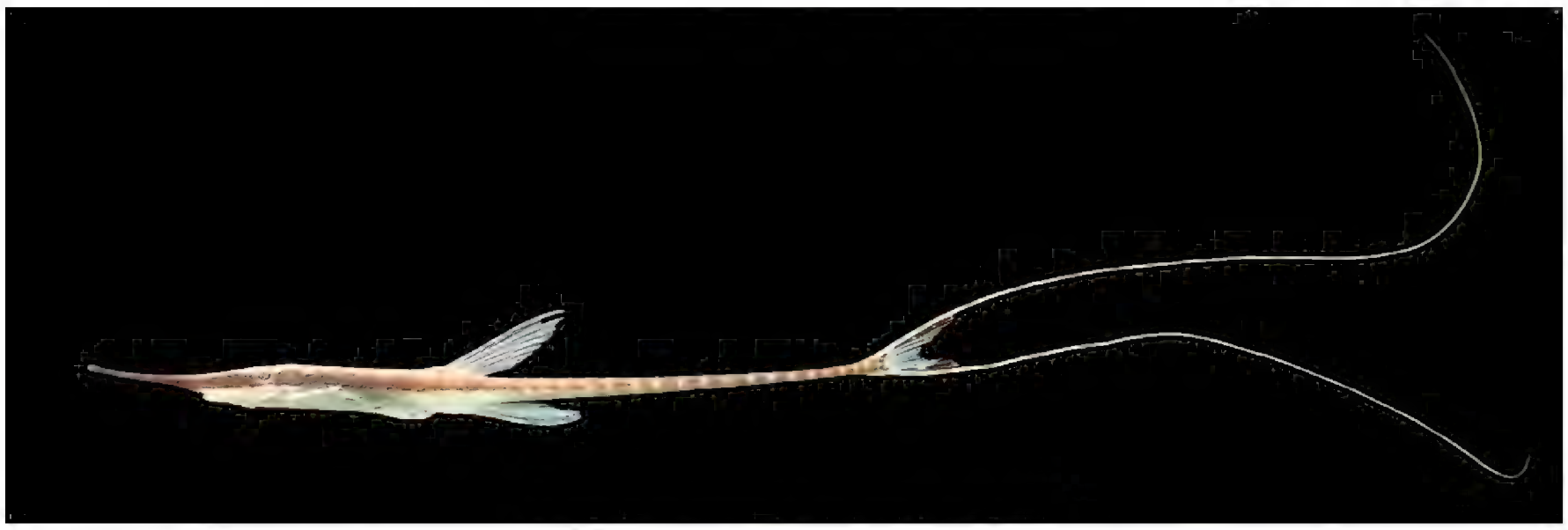
Ancistrus sp. 2, 86 mm (MUSM 36960)

Aphanotorolus unicolor (MUSM 36692)

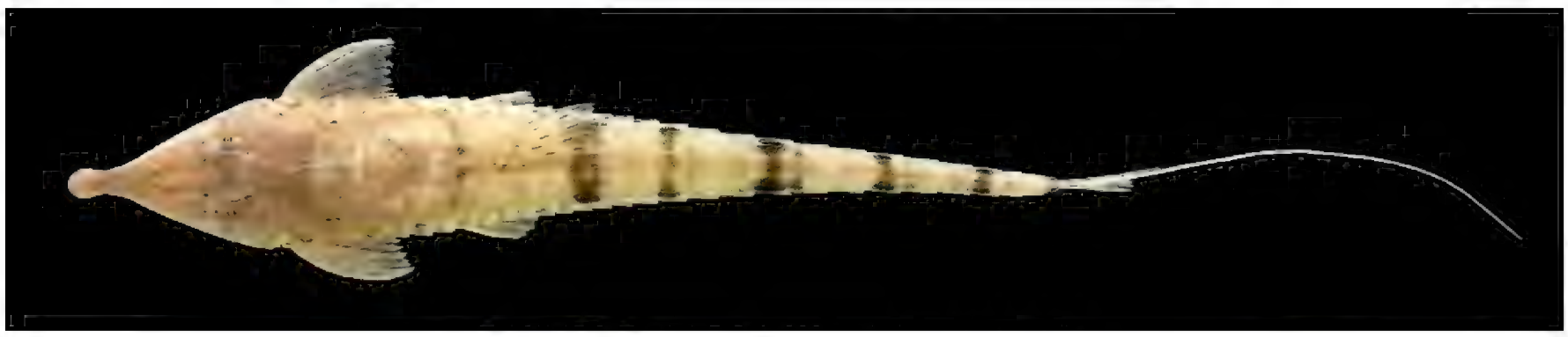
Crossoloricaria bahuaja, 154 mm (MUSM 36703)

Appendix 1. ***Continued.***

Farlowella knerii, 120 mm (MUSM 37091)

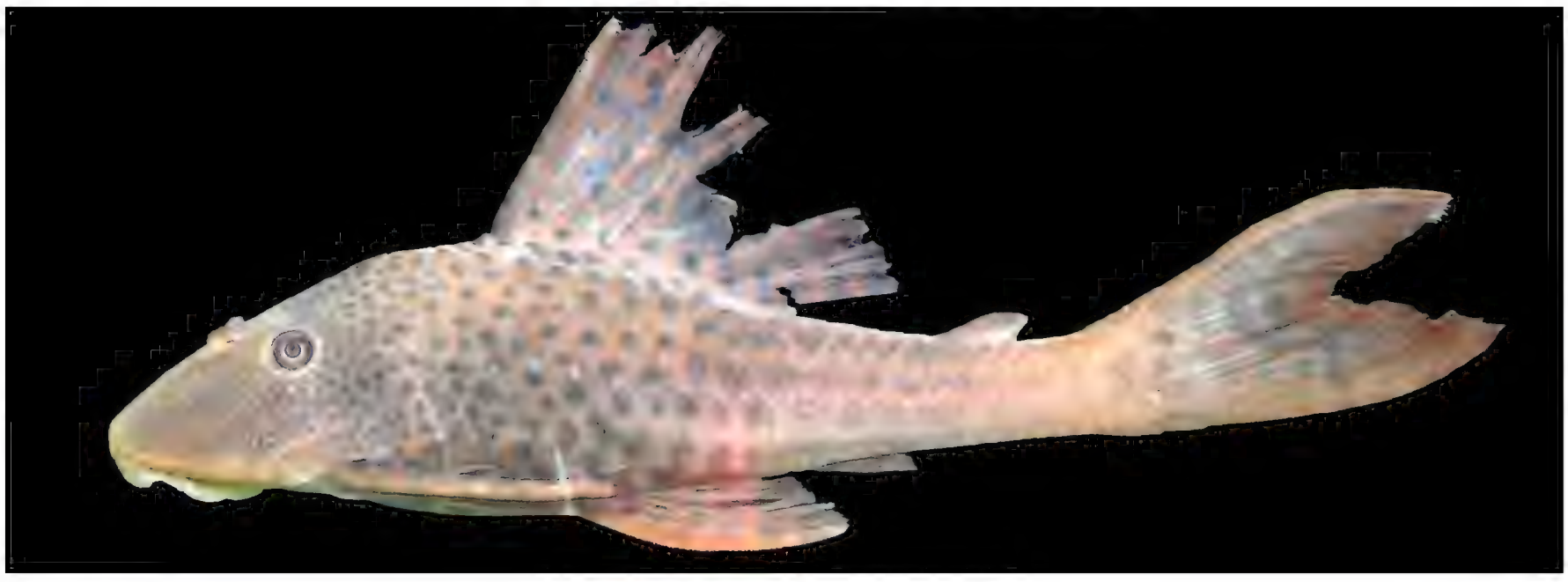


Farlowella nattereri, 94 mm (MUSM 37075)



Hemiodontichthys acipenserinus, (MUSM 36825)

Hypoptopoma incognitum, 70 mm (MUSM 36735)



Hypostomus pyrineusi, (MUSM 37021)

Appendix 1. ***Continued.***

Hypostomus sp., 134 mm (MUSM 36780)

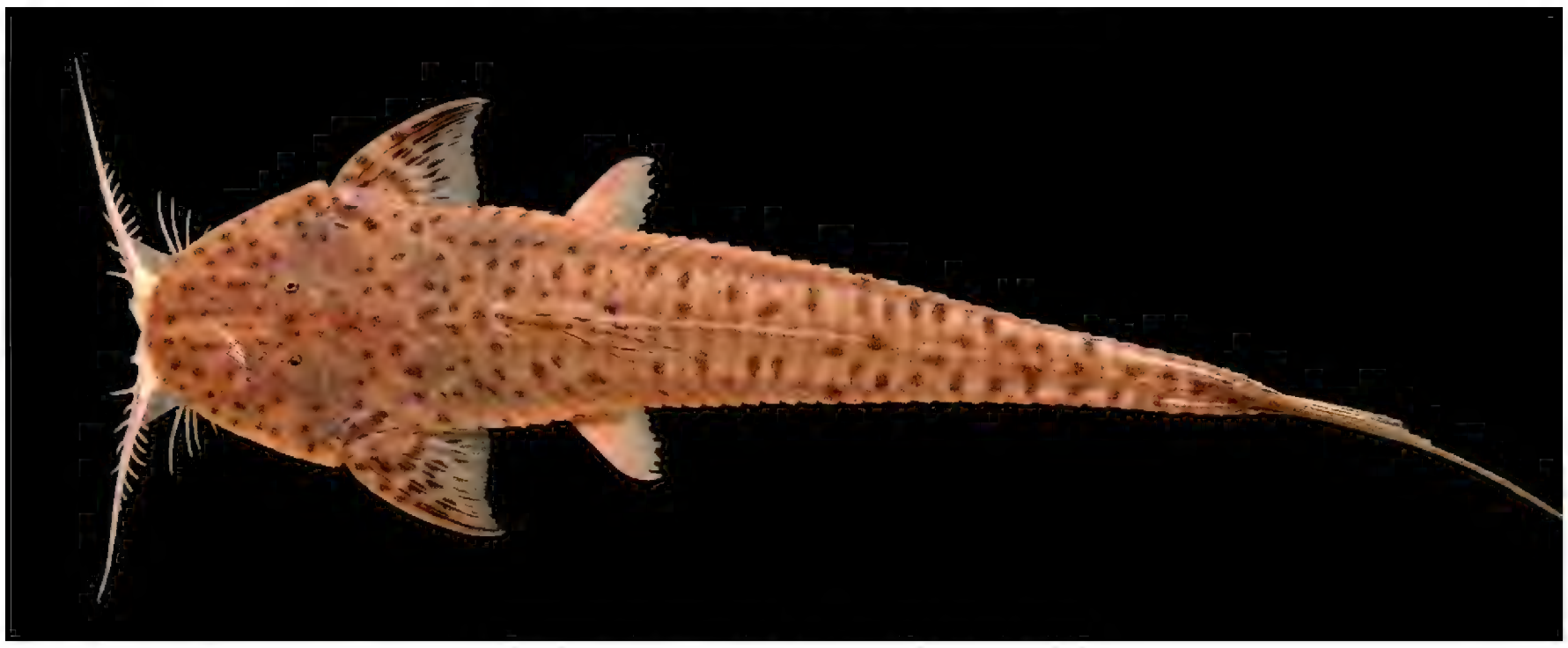
Lamontichthys filamentosus, 158 mm (MUSM 36933)

Loricaria sp., 164 mm (MUSM 36706)

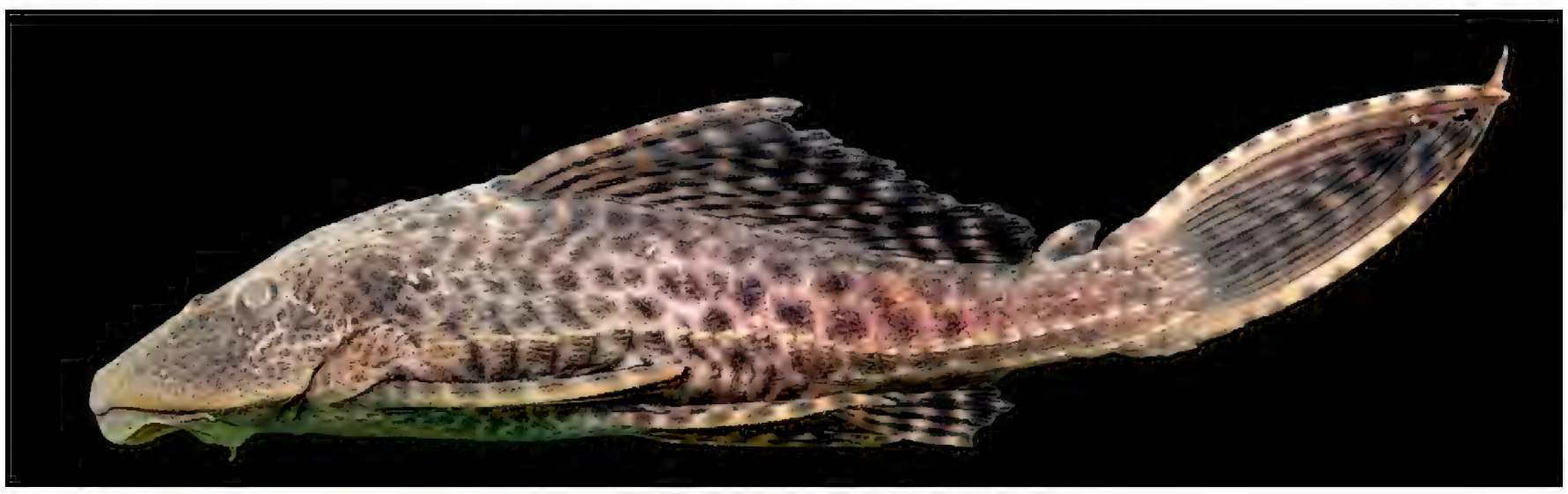
Loricariichthys cf. *platymetopon*, 196 mm (MUSM 36737)

Appendix 1. ***Continued.***

Otocinclus vittatus, 26 mm (MUSM 36949)



Planiloricaria cryptodon, 126 mm (MUSM 36704)



Pterygoplichthys disjunctivus, (MUSM 36896)

Pterygoplichthys punctatus, 73 mm (MUSM 36895)

Appendix 1. ***Continued.***

Rineloricaria lanceolata, 113 mm (MUSM 37019)

Rineloricaria cf. *beni*, 82 mm (MUSM 37090)

Spatuloricaria puganensis, 167 mm (MUSM 36935)

Squaliforma cf. *emarginata*, 212 mm (MUSM 36864)

Appendix 1. ***Continued.***

Sturisoma sp., 138 mm (MUSM 36871)

Cetopsidae

Cetopsis coecutiens, 62.7 mm (MUSM 36748)

Aspredinidae

Xyliphius lepturus, 94 mm (MUSM 36715)

Doradidae

Leptodoras acipenserinus, specimen not preserved

Appendix 1. ***Continued.***

Nemadoras sp., 74 mm (MUSM 36709)

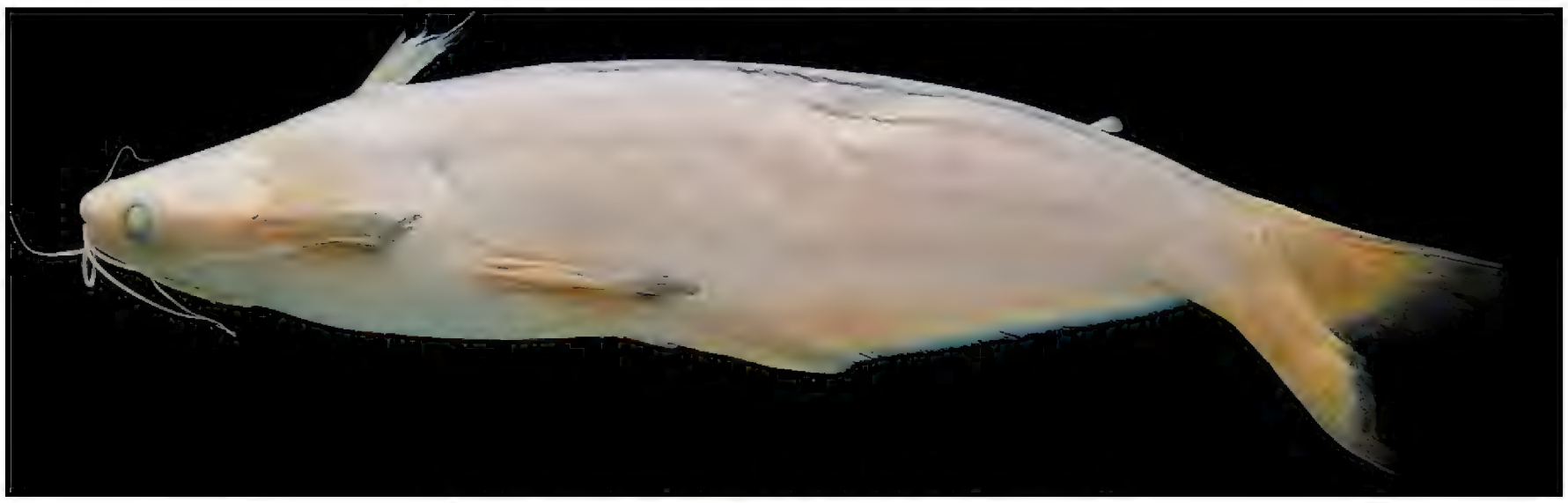
Rhinodoras boehlkei, 146 mm (MUSM 36877)

Auchenipteridae

Ageneiosus inermis (specimen not preserved)

Appendix 1. ***Continued.***

Ageneiosus ucayalensis, 268 mm (MUSM 36932)



Auchenipterus ambyiacus, 170 mm (MUSM uncataloged)

Auchenipterus brachyurus, 110 mm (MUSM 36779)

Appendix 1. ***Continued.***

Centromochlus perugiae, 55 mm (MUSM 36952)

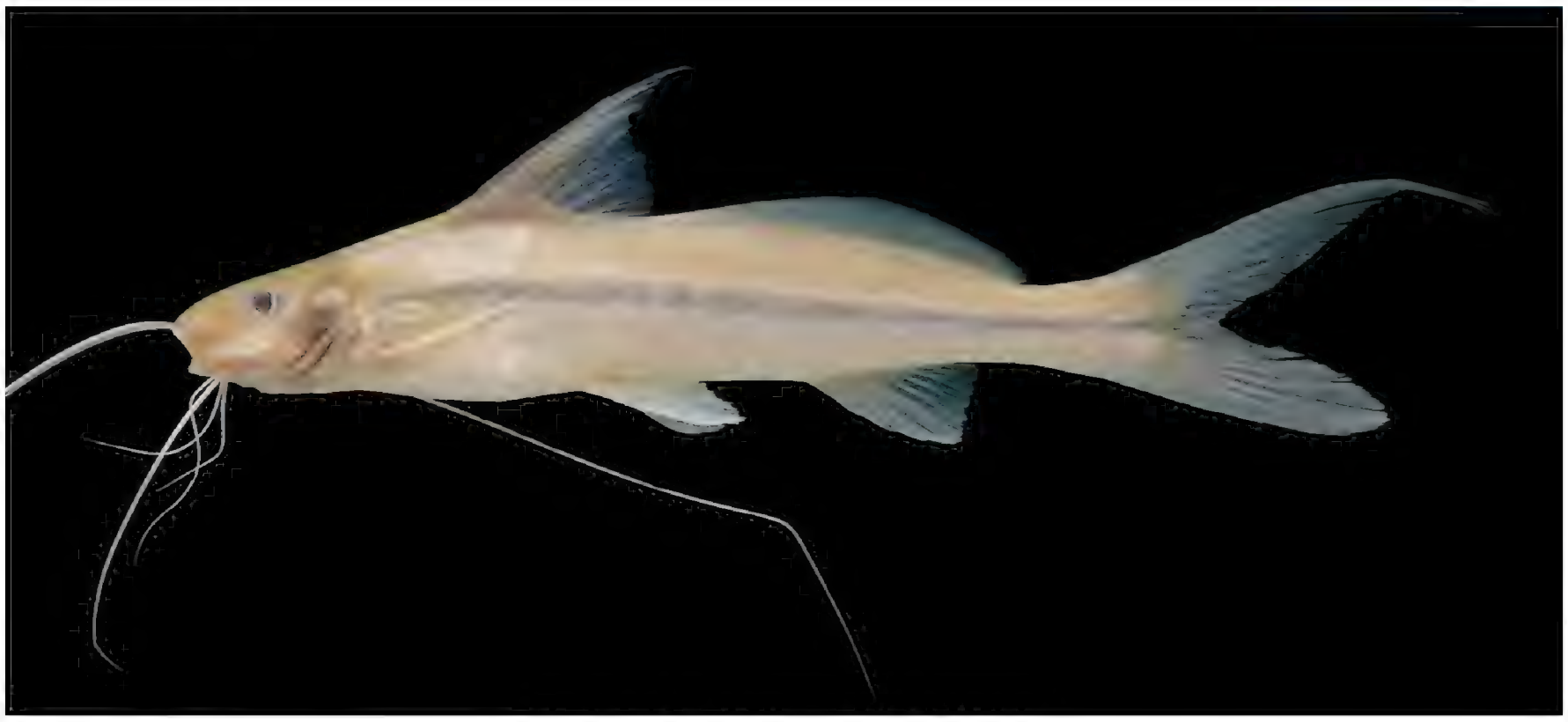
Heptapteridae

Imparfinis stictonotus, 33 mm (MUSM 36840)

Phenacorhamdia sp., 44 mm (MUSM 36961)

Pimelodella sp. 1, 51 mm (MUSM 36777)

Appendix 1. ***Continued.***



Pimelodella sp. 2, 103 mm (MUSM 36839)

Rhamdia quelen, 141 mm (MUSM 36946)

Pseudopimelodidae

Microglanis aff. *iheringi*, 38 mm (MUSM 36948)

Appendix 1. ***Continued.***

Pimelodidae

Aguarunichthys torosus, specimen not preserved

Calophysus macropterus specimen not preserved

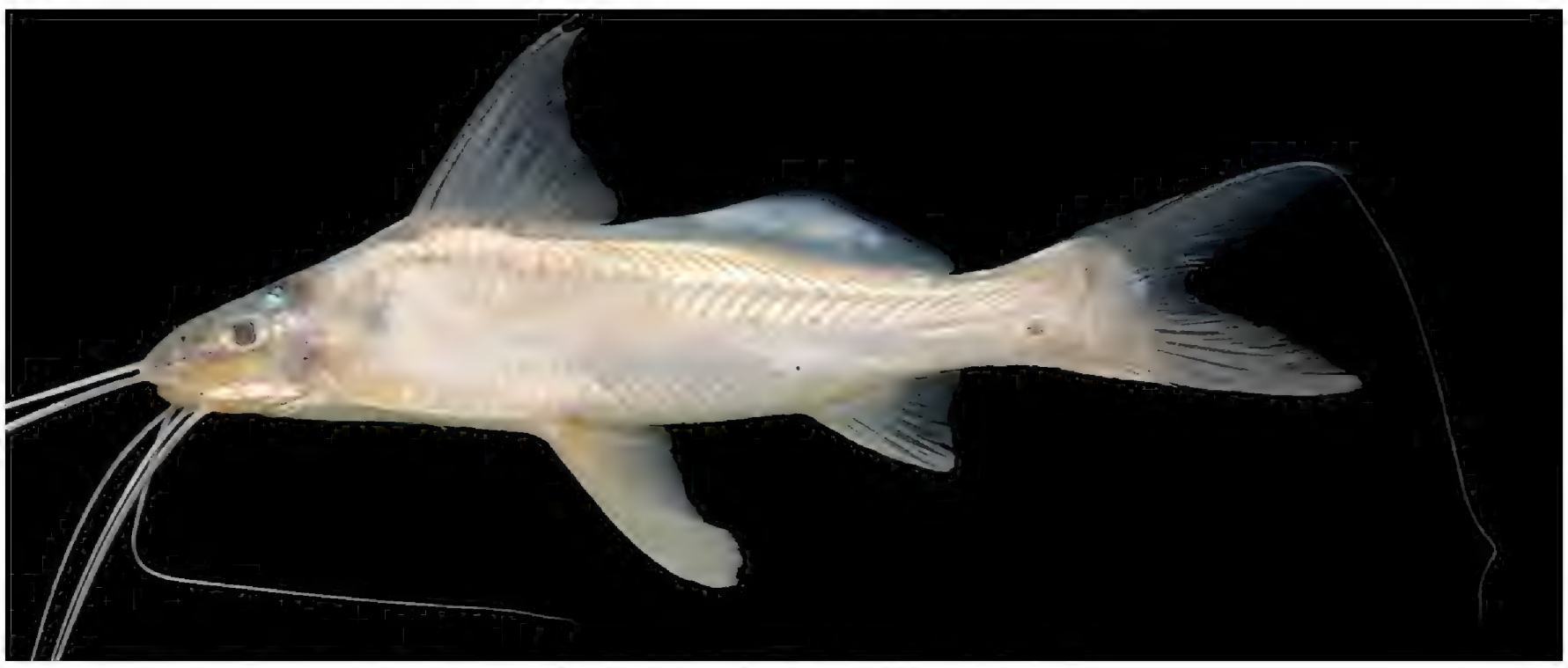
Cheirocerus eques, (MUSM 36707)

Exallodontus aguanai, 124 mm (MUSM 36880)

Appendix 1. ***Continued.***

Hemisorubim platyrhynchus, (MUSM 36696)

Hypophthalmus edentatus, 128 mm (MUSM 36999)



Megalonema amaxanthum, 86 mm (MUSM 36885)

Megalonema platycephalum, 256 mm (MUSM 36773)

Appendix 1. ***Continued.***

Pimelodus altissimus, 114 mm (MUSM 36708)

Pimelodus blochii, 97 mm (MUSM 36694)

Pimelodus aff. *maculatus*, 103 mm (MUSM 37014)

Appendix 1. ***Continued.***

Pimelodus pictus, 71 mm (MUSM 36710)

Pimelodus sp.1, 76 mm (MUSM 36713)

Pimelodus sp. 2, 111 mm (MUSM 36888)

Appendix 1. ***Continued.***

Pinirampus pirinampu specimen not preserved

Platysilurus mucosus, 94 mm (MUSM 3700)

Platystomatichthys sturio, (MUSM 36830)

Sorubim lima, 98 mm (MUSM 37001)

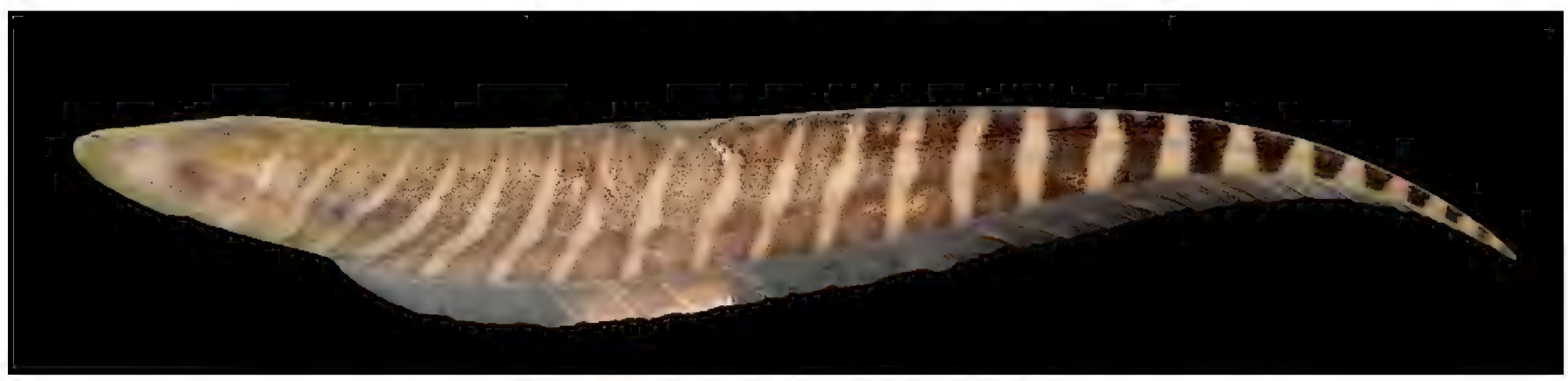
Appendix 1. ***Continued.***

Zungaro zungaro specimen not preserved

GYMNOTIFORMES

Gymnotidae

Gymnotus carapo, 277 mm (MUSM 36793)



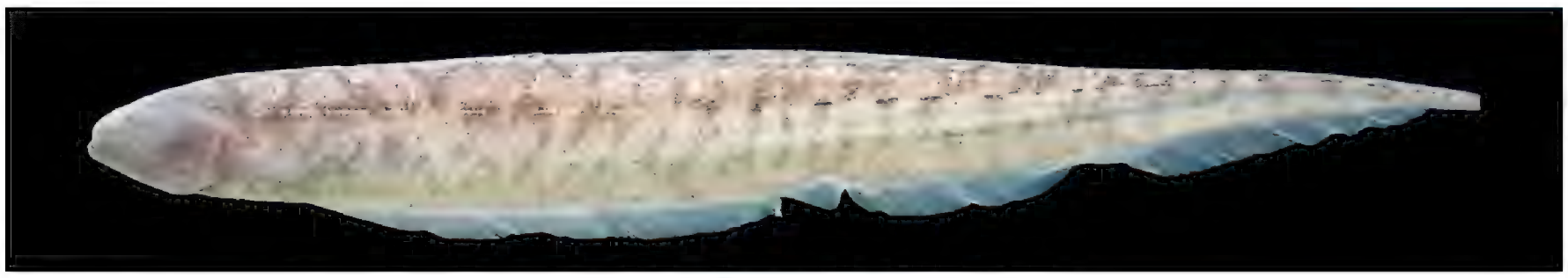
Gymnotus chaviro, 131 mm (MUSM 36842)

Rhamphichthyidae

Gymnorhamphichthys hypostomus, 157 mm (MUSM uncat.)

Appendix 1. ***Continued.***

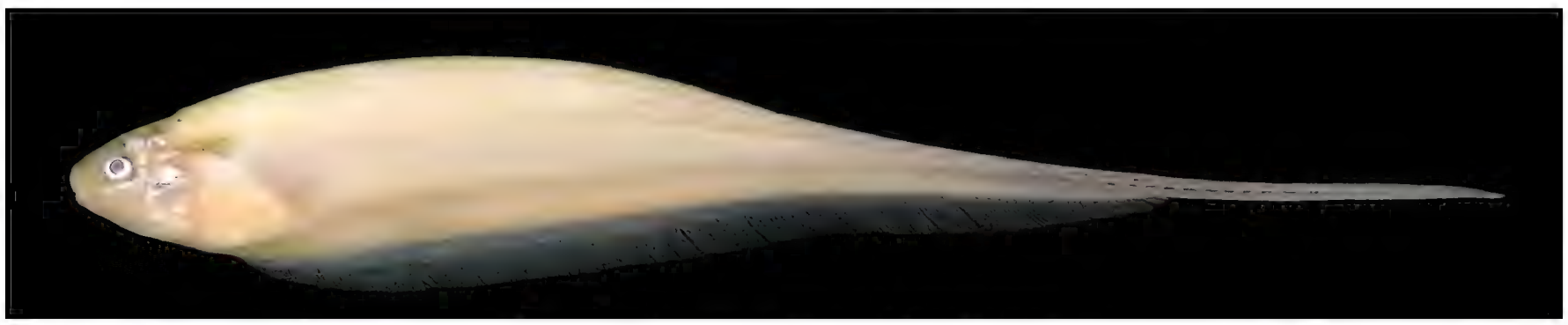
Hypopomidae



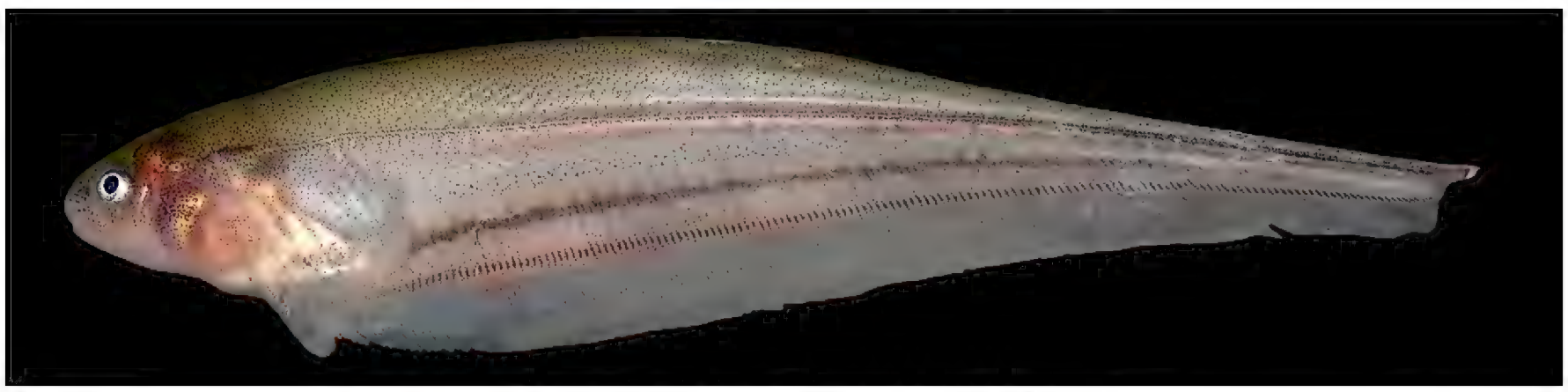
Brachyhypopomus beebei, 84 mm (MUSM 37094)

Brachyhypopomus sp., 120 mm (MUSM 37016)

Sternopygidae



Eigenmannia macrops, 99 mm (MUSM 36873)



Eigenmannia virescens, 89 mm (MUSM 36719)

Eigenmannia sp., 60 mm (MUSM 37102)

Appendix 1. ***Continued.***

Sternopygus macrurus, 121 mm (MUSM 36945)

Apteronotidae

Apteronotus albifrons, 194 mm (MUSM 36939)

Apteronotus bonapartii, 198 mm (MUSM 36837)

Compsaraia sp., 240 mm (MUSM 36837)

APPENDIX 1. ***CONTINUED.***

Sternarchogiton sp., 231 mm (MUSM uncat.)

Sternarchorhynchus cf. *hagedornae*, 307 mm (MUSM 36838)

CYPRINODONTIFORMES

RIVULIDAE

Rivulus sp., 31 mm (MUSM 37022

SYNBRANCHIFORMES

SYNBRANCHIDAE

Synbranchus marmoratus, 257 mm (MUSM 37023)

Appendix 1. ***Continued.***

PERCIFORMES

Sciaenidae

Pachyurus cf. *stewarti*, (MUSM 37056)

Plagioscion squamosissimus, 206 mm (MUSM 36738)

Cichlidae

Aequidens tetramerus, 80 mm (MUSM uncat.)

APPENDIX 1. ***CONTINUED.***

Bujurquina cordemadi, 77 mm (MUSM 37105)

Cichlasoma boliviense, 43 mm (MUSM 37037)

Crenicichla semicincta, 107 mm (MUSM 37036)